EMTiming hardware checkout procedure.

ASD Transition Board (TB)

Purpose of test: Look at the reflections on the ASD side of the TB.

Setup: Look at Figure 3. The schematic for the ASD side of the connection is shown on Figure 1. We decided to go with ***RC*** circuit because it forces the reflection signal to stay below zero, which is below in turn than the ASD threshold. We will fake ASD termination by a P3 connector with 50-Ohm termination for each channel so that we do not have to plug the TB into the crate.

Equipment: Pulse Generator, Scope, TB, P3 connector with 50-Ohm termination.

Steps

1. Set up the generator as a current source (or use PMT), and shape the signal so that it closely resembles the real PMT signal.
2. Send the signal to the TB through the 25 ft cable[1] and look at the signal on the 50-Ohm resistor with the scope using a differential probe.
3. The Picture should look like the blue curve on Figure 2 with a differential probe. Notice that the reflections stay always below zero.
4. All signals should look alike and resemble the blue curve on the Figure 2. You should never see reflected signal above zero. If this is not the case, mark the failed channel and mark the whole board as bad.

ASD board

Purpose of test: look at the ASD signal below ASD threshold, at the threshold, and above it.

Setup: look at Figure 4. When an input signal on the ASD goes above the threshold (~2mV), the ASD fires an LVDS signal that is ~80 nsec long, and stays blind to any input for another ~20 nsec. The input voltage should go below the threshold for ASD be able to fire again. The ASD board must not fire at all if the input signal is well below the threshold, fire at 50% rate for the input signal at the threshold, and fire at 100% rate when the input is well above the threshold.

Equipment: Pulse Generator, Scope, ASD, TB, VME crate, 25 feet cable, TDC Toy Board.

Steps

1. Start by setting the Pulse Generator so that the signal is ~50 nsec long; the frequency should be less than 2 MHz.
2. Put ASD and TB into the working VME crate. Use a short cable to connect the ASD to the TDC in order to avoid changing the shape of the ASD output.
3. For each channel use 3 Pulse Generator settings for the signal: one is below the threshold, one is at the threshold, and the last one is above the threshold.

[1] The cable length should be the same as the length of the harness.

4. On the scope you should see no signal synchronous with the generator pulse[2], LVDS signal for ~50% of the Generator pulses, and 100% of the Generator pulses respectively. The width of the LVDS signal must be at the specified value and not change from channel to channel. Otherwise mark the failed channel and mark the whole board as bad.

Long Cable

Purpose of test: To check how each twisted pair of conductors in the cable transmits LVDS signal from the ASD into the TDC.

Setup: Look at Figure 5. One has to trigger ASD into producing a signal and look at the shape of the signal on the other end of the cable. It is sufficient to test the width of the signal as it comes out of the Toy TDC Board[3].

Equipment: Pulse Generator, Scope, ASD, TB, VME crate, Long Cable, TDC Toy Board.

Steps

1. Start by selecting a working ASD Transition Board (TB), and working ASD; put them into the VME crate.
2. Use the pulse generator to produce pulses with characteristics shown on the Figure 5. The pulse must be well above the ASD threshold, the width of the pulse above the threshold must be approximately as wide as the real PMT signal, and the frequency of the pulses must be low enough to allow the cable to discharge between the impulses.
3. Send the pulse into the TB **channel by channel**[4] and look at the output of the TDC Toy Board with the scope.
4. You should see the LVDS signal a little bit less wide than the ASD LVDS signal width. **All lines should have the same width.**
5. If there is a problem one can look at the signal on the resistor just in front of the Toy Board LVDS receiver with the differential probe. If the signal in this line is different from the other lines, mark this channel as bad.

[2] Because of the noise the input signal might go above the threshold, but it will be asynchronous with the generator pulse

[3] The board allows seeing how the LVDS receiver on the real TDC board behaves.

[4] Do not fire all ASD channels at once. The ASD LVDS drivers behave differently in such case.

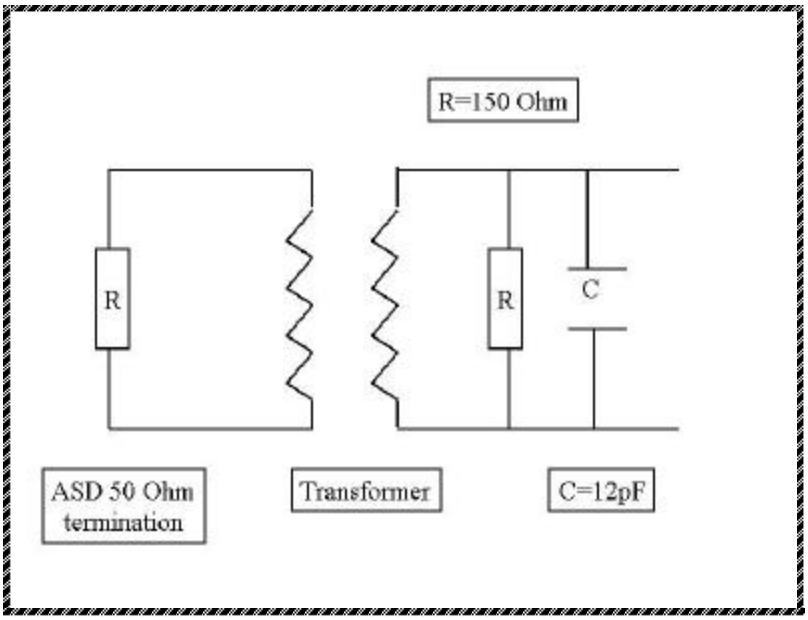

Figure 1
TB-ASD side connection

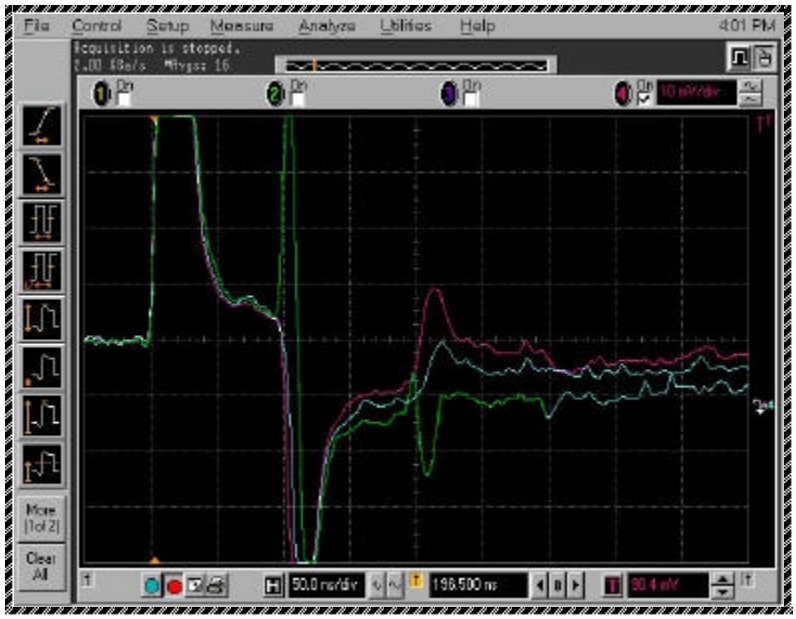

Figure 2
Blue shape is the signal on 50-Ohm resistance with ***RC*** TB.

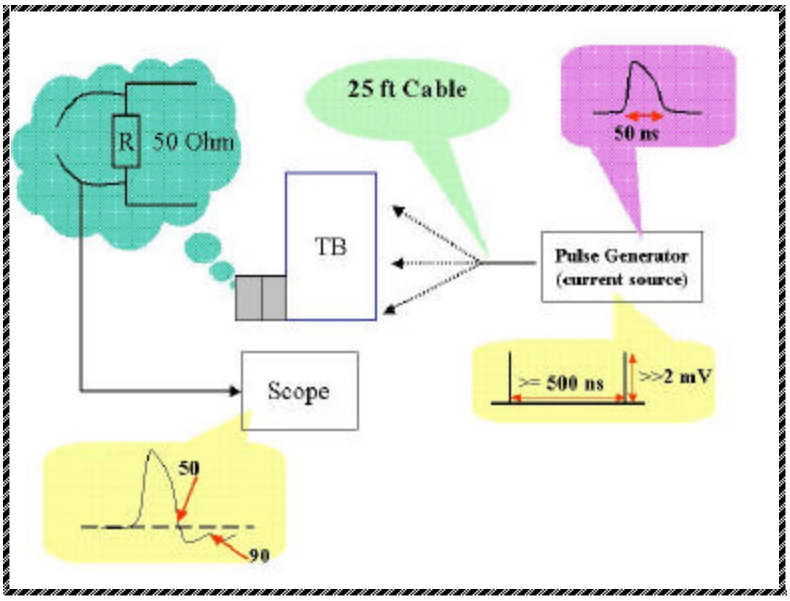

Figure 3
ASD TB checkout procedure schematics.

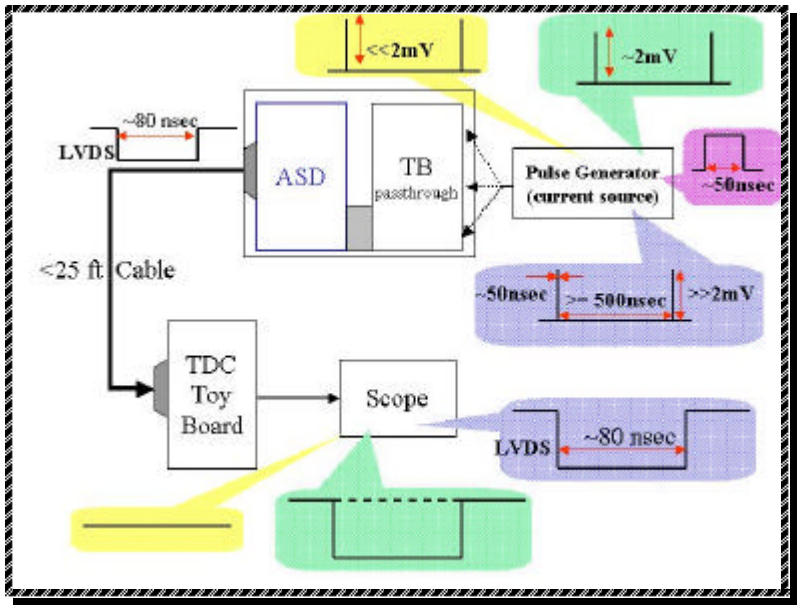

Figure 4
ASD board checkout procedure schematics.

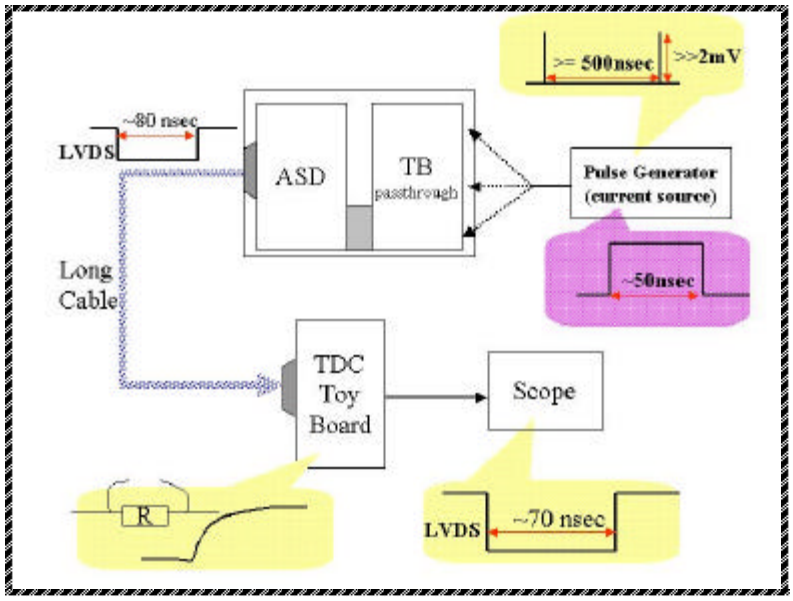

Figure 5
Long Cable checkout procedure schematics.